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DETERMINANTS OF FERTILITY IN TWO CANADIAN POPULATIONS: A CAUSAL MODELING APPROACH

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Abstract

A causal model is constructed to show that the demand for children is primarily a function of social psychological processes within the family, subject to certain socioeconomic constraints. Three broad socio psychological processes are posited as determinants of fertility. The first is the couples level of modern objects scale; the second is life satisfaction and the communication between the husband and wife; and, the third is attitudes or tastes of family members towards children. Socioeconomic variables, such as husbands education, wifes education and household income, are hypothesized to influence fertility through their impact on social psychological processes within the family. The proposed model is tested on two independent samples--one in Cold lake, the second in Fort McMurry--using a structural equation model by maximum likelihood methods.

Over the past several decades, research on the determinants of fertility has proliferated. Recent research has focused on factors affecting fertility levels and changes in less developed countries, especially with regards to the relative importance of socioeconomic development and family planning programs(eg; Tsui and Bogue, 1978;Kelly and Cutright, 1980;Cutright and Kelly, 1981; Mauldin and Berelson, 1978). Much less research has dealt with determinants of fertility among more developed countries. In addition, most of the research is based on aggregate, rather than on individual level data. In order to understand the complex phenomenon of fertility, data on various socioeconomic and psychological factors are important at the

individual level.

The complex nature of causation in fertility behaviour has motivated scholars from several disciplines to develop a comprehensive theoretical frame work with the inclusion of all relevant variables (Davis and Blake, 1956; Freedman, 1962; Bullato and Lee 1982a). Theories from economics, sociology and demography typically stress the constraining role of environment. In this approach households are hypothesized to choose a family size in response to price, income, norms or other social stimuli. On the other hand, theories from Psychology, begin with people's needs, motives or other mental events to model the primary antecedents of fertility(Bagozzi and Van Loo, 1978). Some psychological theories are concerned with the decision process itself or the rules governing it (eg., Fishbein, 1972; Hass, 1974), whereas others, while not explicitly concerned with this process, investigate individual preferences and values which are relevant if decisions are actually made (eg., Hoffman and Hoffman, 1983). Among anthropological approaches, several discuss fertility determinants at the societal or cultural level with no references to couples making decisions; others focus specifically on these decisions(Bartlett, 1980; Hull, 1982).

A more general theory of fertility developed by Bagozzi and Van Loo(1978), claims that fertility is an outcome of two broad social processes within the family unit. The first

hypothesizes that the shared, socially constructed attitudes of households members influence family size. The second posits that the social exchanges that transpire between husband and wife affect fertility. The theory views the social and economic variables as constraints on attitudes and on husband-and-wife interaction(Bagozzi and Van Loo, 1978).

Theoritical models discussed above are tested by researchers mostly based on data from Less Developed countries. In addition, many of those studies suffer from inadequate data or unsatisfactory data analysis.

The general theory of fertility proposed by Bagozzi and Van Loo has certain theoritical and methodological benefits over the traditional demographic approaches to study fertility behaviour (see; Bagozzi and Van Loo 1978, p 317-318). In this paper an attempt is made to develop and test a model similar to Bagozzi and Van Loo. The model is tested among two canadian populations, one is more homogeneous (Fort Mcmurry) than the other (Cold Lake) with regard to certain socioeconomic and demographic characteristics.

General Model

As shown in figure 1, fertility is hypothesized to be a direct function of social psychological process within the family and an indirect function of socioeconomic constraints on family size.

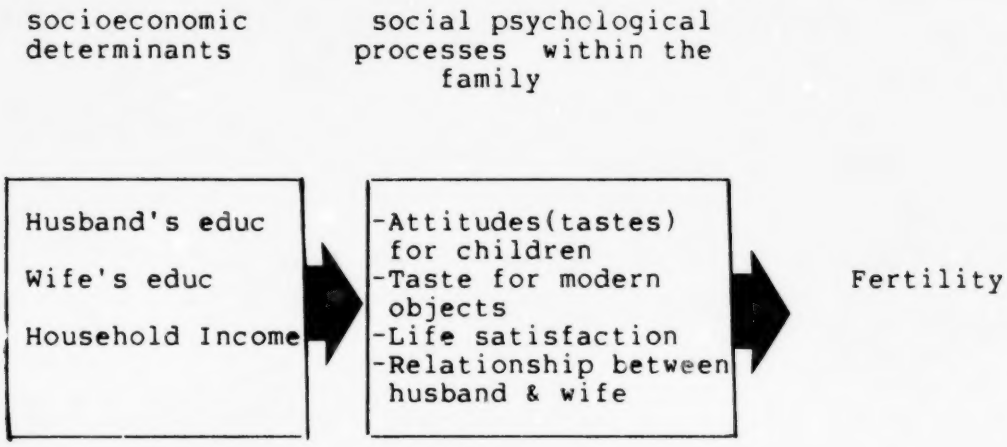


Fig 1. Determinants of fertility.

Indirect influences of socioeconomic determinants on fertility have been outlined by Easterlin(1969), Namboodiri(1972a,1972b), Leibenstein(1974,1975) and Turchi(1975). According to Bagozzi and Van Loo(1978), the socioeconomic variables, such as education, income, occupational status etc serve not only as resources for families in the achievement of desired ends, but these factors "are also positional variables in the social structure" and affect decision making as to family size. The family's socioeconomic status also plays a role by forcing couples to make comparisons with others in their social class or desired social class and thus influence the couple to conform to a particular life style. In other words, in order to maintain a particular social status, the family is forced to adopt particular type of consumption and family size. For example, there is more social pressure on families

with high socioeconomic statuses to provide extensive child services, and spend more on recreation and travel than there is on lower socioeconomic status families. These variables tend to have a negative influence on family size decision making.

The main social psychological process within the family involves a decision regarding the family size. In general, the decision depends upon the needs of the husband and wife; life satisfaction and communication or interaction between the two. A large number of studies have investigated the notion that fertility depends complexly on the nature of relationship between husband and wife. Namboodiri(1972b), for example, has developed a causal model for explaining fertility as a by-product of interaction between husband and wife.

Data and Methodology

The data for the present study was obtained from two independent surveys conducted in Alberta; one in the Cold Lake region(n=1207) and the other in Fort McMurry(n=430). Both surveys were conducted in 1979 to study the social impact of developing natural resources in these communities. Details on the format of questions, procedures and cautions used in collecting the data are discussed in Gartrell et. al,(1980). Discussion here will focus on the description of variables and their relationship to the proposed model. The proposed model is tested among the currently married women

Fig 2. Proposed model for the determinants of fertility

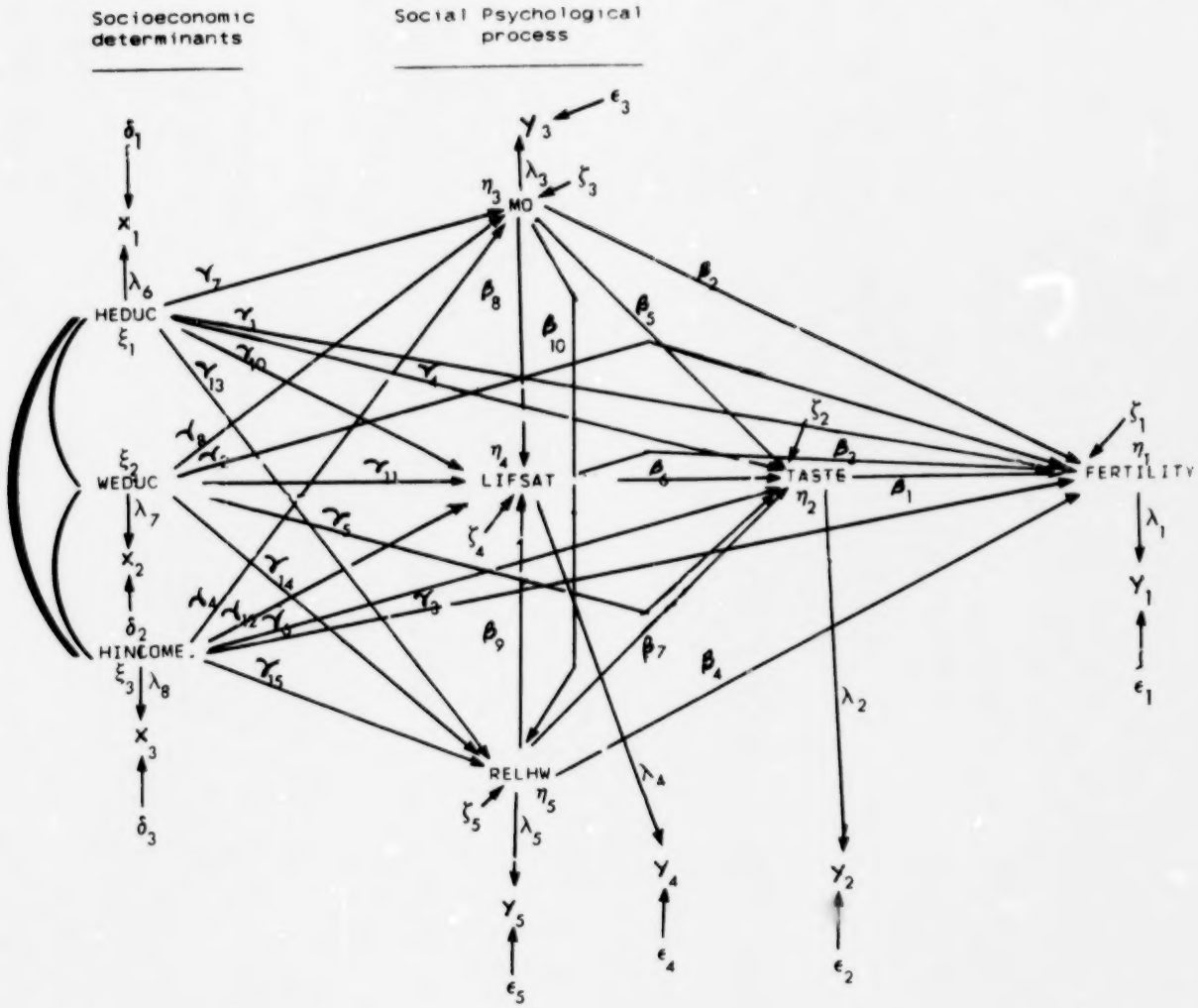
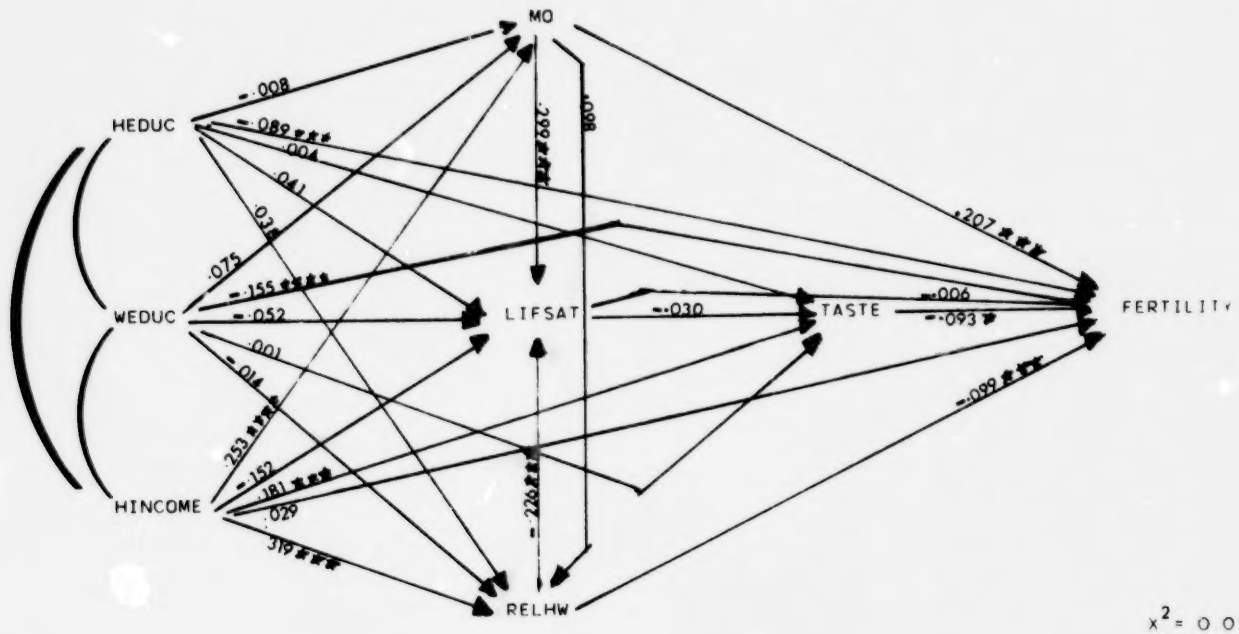


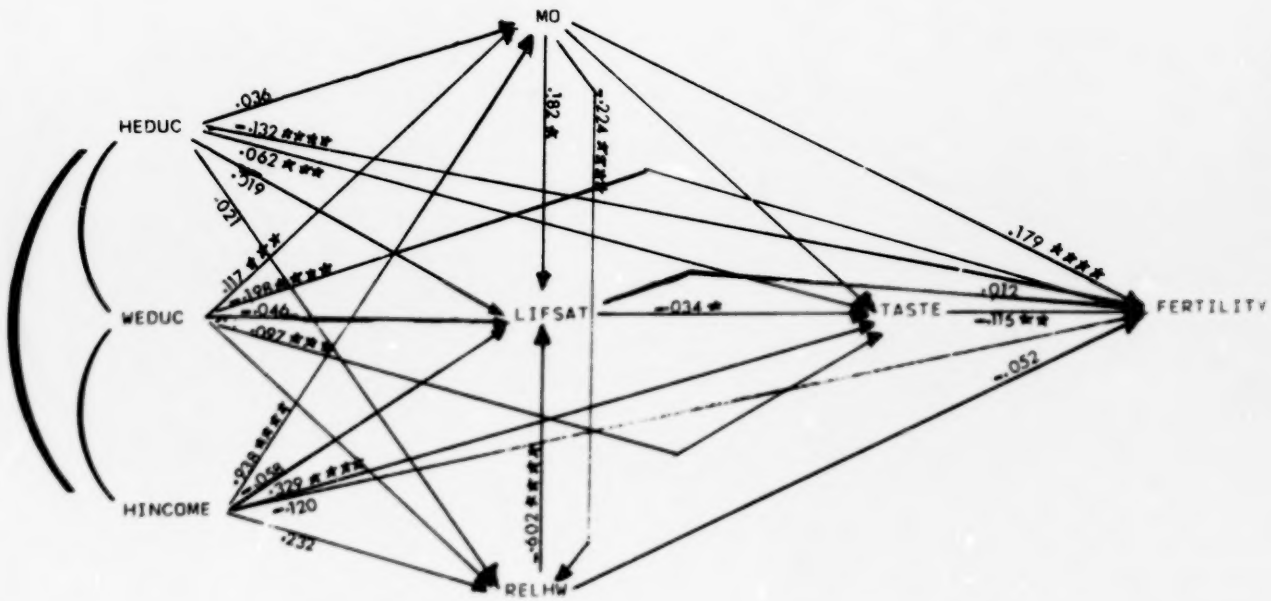
Fig 3 Findings for Fort McMurry and the Model of Fig 2



x^2 = 0.01 Df = 7 P = 1.000
GFI = 1.000 R^2 = .212

Note: The level of statistical significance of each estimate under the one tailed t-test is indicated by ****,***,**, and * for one,two,five and ten per cent levels respectively.

Fig 4. Findings for Cold Lake and the Model of Fig 2



x^2 = .27 Df = 7 P = 1.000
GFI = 1.000 R^2 = .522

of reproductive ages(under 54 years old).

The proposed general model testing the theory is outlined in figure 2. A definition of symbols used in the model is presented in table 1. The model indicates that all the exogenous variables(HEDUC,WEDUC & HINCOME) have a direct influence on all of the intervening or predetermined variables. In other words, as socioeconomic status increases, satisfaction in life, the relationship between husband and wife, modern objects and the approval of married couples not having children, increases. The hypothesis posited here is that, as attitude or tastes for children and social exchanges within the family become more modern, couples' demand for quality than quantity and thus reduce the family size.

In order to estimate the parameters in Fig 2, a LISREL program (version V, 1981) provided by Joreskog and Sorbom is used. The Lisrel program uses the full information maximum likelihood procedure to get the estimates.'

Findings

Figures 3 and 4 present parameter estimates for the recursive models for Fort McMurry and Cold Lake respectively. Tables 2 and 3 provide indirect and total effects of exogenous and endogenous variables for the models.

' For brevity the specification of the model and the calculation of measurment errors are not included here.

Table 1. Definition of symbols used in figure 2

ξ_1 = *husband's education(HEDUC)*
(X_1) = husband's completed years of education

ξ_2 = *wife's education (WEUDC)*
(X_2) = wife's completed years of education

ξ_3 = *household income (HINCOME)*
(X_3) = family income, total income from all sources of all family members in the household (divided by 1000)

η_1 = *fertility*
(Y_1) = total number of children the respondent is plan to have

η_2 = *taste for children (TASTE)*
(Y_2) = do the respondent approve or disapprove of a married couple not bearing or rearing children (strongly disapprove = 1 ... strongly approve = 7)[1]

η_3 = *modern objects scale (MO)*
(Y_3) = possession of a dishwasher,microwave oven,automatic washer, dryer,freezer,color Tv,gas barbecue,skis etc.

η_4 = *satisfaction in life (LIFSAT)*
(Y_4) = respondents satisfaction with the family life,friends,neighborhoods, etc (very dissatisfied = 1 ... very satisfied = 7)

η_5 = *the social exchange processes or interaction between husband and wife (RELHW)*
(Y_5) = a) spouse disagreement about house keeping,work schedules,spending money, and visiting or writing relatives (never = 1 ... very often = 5)
b) husband-wife communication; discussion about work (jobs,housework), and sharing personal problems (never = 5 ... very often = 1)[2]

λs *(lambda) = structural coefficients relating unobserved or theoritical variables to observed variables*

ϕ *(phi) = covariance of the exogenous theoritical variables* ξ_1, ξ_2, *and* ξ_3.

γs *(gamma) = structural coefficients relating exogenous, theoritical variables (ξs) to the endogenous variables (ηs)*

βs *(Beta) = structural coefficients relating the endogenous theoritical variables*

δs *and* ϵs *(delta and epsilon) = measurment errors in observed variables, X and Y, respectively*

ζs *(zeta) = errors of prediction.*

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[1] Higher scores on this would indicate the higher dgree of approval for married couples not bearing or rearing children.
[2] Higher scores on these indicators would mean greater disagreement and poor communication between husband and wife

Table 2. Indirect and Total effects of endogenous and exogenous variables for the Fort McMurry Model

	TASTE		MO		LIFSAT		RELHW		HEDUC		WEDUC		HINCOME	
	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE
FERTILITY	--	-.093	-.007	.200	.002	-.004	-.089	-.098	.006	-.095	.017	-.138	.003	.032
TASTE			-.008	-.041	--	-.030	.007	.007	-.001	.003	-.001	-.000	-.004	.177
MO									--	-.008	--	.075	--	.253
LIFSAT			-.022	277	--	--	--	-.226	-.011	.030	.024	-.028	-.002	-.154
RELHW			--	.098					-.048	.038	.007	-.007	.025	344

Table 3. Indirect and Total effects of endogenous and exogenous variables for the Cold Lake Model

	TASTE		MO		LIFSAT		RELHW		HEDUC		WEDUC		HINCOME	
	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE	IN	TE
FERTILITY	--	-.115	.036	.215	.004	.016	-.009	-.061	.000	-.132	-.006	-.204	148	.028
TASTE			-.011	-.176	--	-.034	.021	.021	-.007	.055	-.012	.085	-.158	.171
MO									--	.036	--	.117	--	.938
LIFSAT			135	.317	--	--	--	-.602	-.001	.018	-.145	-.191	.157	.099
RELHW			--	-.224					-.008	.013	-.027	.275	-.210	.022

Table 4. showing standardized coefficients, disturbance terms and degree of determinancy for the Fort McMurry model

STANDARDIZED COEFFICIENTS

	HEDUC	WEDUC	HINCOME	FERT	TASTE	MO	LIFSAT	RELHW
FERTILITY	-.158	-.233	.026		-.100	.252	-.015	-.162
TASTE	.006	.002	.152			-.037	-.065	
MO	-.012	.094	.187					
LIFSAT	.031	-.034	-.059			.157		-.160
RELHW	.042	-.013	.176			.073		
R^2				.193	.029	.047	.048	.045

Disturbance terms, Variances and Covariances

PSI (ψ)				1.886	2.614	3.293	11.911	5.967
TE (θ_ϵ)				.260	.299	.384	1.238	1.103
TD (θ_δ)	.819	.591	.211					

Table 5. showing standardized coefficients, disturbance terms and degree of determinancy for the Cold Lake model

STANDARDIZED COEFFICIENTS

	HEDUC	WEDUC	HINCOME	FERT	TASTE	MO	LIFSAT	RELHW
FERTILITY	-.220	-.251	-.057		-.091	.178	.021	-.071
TASTE	.131	.156	.197			-.208	-.077	
MO	.061	.149	.447					
LIFSAT	.018	-.033	-.016			.102		-.463
RELHW	.026	.279	.080			-.163		
R^2				.228	.120	.307	.231	.091

Disturbance terms, Variances and Covariances

PSI (ψ)				3.768	2.673	3.334	11.790	8.254
TE (θ_ϵ)				.151	.337	.535	1.516	1.602
TD (θ_δ)	.137	.866	.122					

Endogenous Variables

Looking first at the Fort McMurry findings, it is evident that, with the exception of life satisfaction, variables within the social psychological processes of the family have a significant influence on fertility. The modern objects scale(MO) has an unxpected positive influence on fertility. Further, both MO and RELHW have a negative influence on fertility indirectly through LIFSAT and TASTE. The impact of RELHW on fertility, is strong in both direct and indirect sense. The standardized coefficients given in table 4 shows that MO(.252) has stronger influence on fertility followed by RELHW(-.162) and TASTE(-.100).

Looking at the findings from the Cold Lake region, we see that all the variables, except RELHW in the social psychological processes, have a significant influence on fertility. In addition, variables within social psychological processes have a significant influence on each other in contrast tothe Fort McMurry data. However, the positive influence of MO on fertility and negative influence on TASTE are unexpected. The standardized coefficients given in Table 4 show that MO(.178) has a stronger influence on fertility followed by TASTE(-.091).

In sum, social psychological variables within the family are more significantly related to each other in

determining fertility in the Cold Lake model than in the Fort McMurry model. In both communities, the satisfaction in life(LIFSAT) has no significant direct influence on fertility.

Exogenous variables

The model for Fort McMurry(fig 3) shows that both husband and wife's education have a significant direct influence on fertility. On the other hand, the variable HINCOME influences fertility through social psychological processes within the family. Further, the positive influence of HINCOME on TASTE and RELHW are unexpected.

The socioeconomic variables in Fig 4 for the Cold Lake region demonstrates that both husband and wife's education have a significant direct influence on fertility. Though, both HEDUC and WEDUC have significant impact on some of the socio-psychological variables within the family, their indirect influence is negligible. The impact of HINCOME on fertility is also indirect (.148) rather than direct. All three variables(HEDUC,WEDUC & HINCOME) have a significant direct influence on TASTE. Surprisingly, wife's education(WEDUC) has a significant positive influence on RELHW. The indirect and total effects of exogenous variables given in table 3 show a better picture of the influence of these variables on fertility through social

psychological processes.

In sum, socioeconomic variables in both communities show significant direct influences on fertility. The indirect influence of the vairables on fertility are slightly higher in Cold Lake. Further, the variance explained in fertility by exogenous and endogenous variables are 21.2% and 52.2% for Fort McMurry and Cold Lake respectively. The Chi-square value and Goodness of Fit Index(GFI) suggest a perfect fit of the models. However, the large amount of measurment errors in LIFSAT(1.516,1.238) and RELHW(1.602,1.103) indicate the problems involved in measuring these concepts by their respective indicators.

In general, the educational status of husband and wife have a significant influence on fertility. The significant influence of HEDUC & WEDUC on TASTE in the Cold Lake model suggests that as the educational status of the couples increases, they tend to substitute goods for children. The influence of HINCOME on fertility through the social psychological process are stronger in Cold Lake (.148) than in Fort McMurry(.003). The significant impact of HINCOME on MO and TASTE suggest that an increase in income is likely to increase the taste for children and modern goods. However, the total effect of HINCOME on TASTE in Cold Lake is reduced by the presence of MO,LIFSAT and RELHW. As shown in Fig 4,

LIFSAT is not directly influenced by any of the exogenous variables. On the contrary, the relationship between husband and wife(RELHW) is influenced directly by , WEDUC in Cold Lake and HINCOME in Fort McMurry, both exogenous variables. The latter findings are contradictory to the general expectation and suggest that an increase in WEDUC and HINCOME is likely to increase disagreement between the husband and wife, and reduce the communication between them.

Discussion and conclusions

The causal model proposed here i.e, fertility is a direct function of social psychological factors constrained by socioeconomic variables, holds true to a greater extent in Cold Lake than Fort McMurry. In both populations, the socioeconomic factors (except HINCOME) seem to play a dominant role in explaining fertility. These findings are supported by other recent canadian studies (Balakrishnan et al, 1975; Henripin and Lapierre-Adamyck, 1974; Vlassoff and Gartrell, 1982). The present study does not support findings that socioeconomic variables are less effective in explaining fertility in Canada (Lapierrie-Adamyck,1979)and that the direct effect of differences in development(eg.,HEDUC,WEDUC &MO) on fertility will be small.

In general, fertility is influenced by HINCOME through social psychological processes within the family. The indirect influence of husband and wife's education are negligiable in Cold Lake despite their significant influence on social psychological variables. There are a number of plausible explanations for this finding. First, the population of Fort McMurry is quite young, highly mobile and economically motivated (Vlassoff and Gartrell, 1982) in comparison to the Cold Lake region. Also, Fort McMurry posseses a high level of family and community satisfaction (Vlassoff and Gartrell, 1982). Second, the indicators(modernization objects,life satisfaction, taste and relationship between husband and wife) do not seem to capture the realm of social psychological processes in contrast to many researchers expectations. Third, the large amount of structural and measurement errors indicate the omission of important variables as well as discrepancies in measuring the concepts by the proposed indicators (see: Namboodiri, 1972a; Turchi, 1975; Goldberg 1975; Bagozzi and Van Loo, 1978).

The explained variance (R^2) obtained for the models are comparatively larger than those found by other researchers for similar models at the individual level(Willis, 1973; Goldberg, 1975; Bagozzi and Van Loo, 1978). Apart from theoritical benefits, methodologically

the proposed model allow the researcher to model a cause and effect relationship among the variables allowing for certain measurment and structural errors to remain in the model. Moreover, one can test the goodness of fit through indices like Chi-square and Goodness of Fit Index. Further, the diagnostic tools available in Lisrel enable the researcher to build the model closer to the real world.

Finally, given the complex nature of the fertility phenomenon, people often respond differently based on their socioeconomic and cultural background. The study suggests that socioeconomic variables continue to play a dominant role in explaining fertility, the role of social psychological processes is not captured by the present study. The variables used to measure the social psychological processes within the family are often remain at theoritical level and not empirically tested by researchers. The theoritical model tested by Bagozzi and Van Loo by using data from two developing societies, however, shows the inefficiency of social psychological factors in determining fertility. The findings of present study based on data from two developed societies further supports Bagozzi and Van Loos' assertion. In developed societies, one would expect social psychological factors (modernization, life satisfaction & interaction or communication between husband and wife)

to play a dominant role due to universal education and low level of income inequalities. But that do not seem to hold true. A major problem is the large amount of error involved in measuring the concepts. This leads us to question the role and validity of social psychological factors in fertility analysis. More concrete measures must be developed in order to understand the degree of interaction and communication between husband and wife in explaining fertility phenomenon.

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REFERENCES

BAGOZII, R.P.,AND M.F. VAN LOO
1978 Toward a general theory of fertility behaviour :A causal modeling approach. Demography 15(3):301-319.

BALAKRISHNAN, T.R., J.F. KANTNER AND J.D. ALLIGHAM
1975 Fertility and Family Planning in a Canadian Metropolis. Montreal:McGill.

BARTLETT,P.F
1980 The Anthropological approach to fertility decisionmaking. P 163-183. In T.K. BURCH(ed.,), Demographic Behaviour:Interdisciplinary perspectives on Decision-making. Boulder, coll:Westview press.

BULATAO, R.A., R.D. LEE WITH P.E. HOLLERBACH AND J. BONGAARTS, eds.
1982a Determinants of Fertility in Developing Countries:A summary of Knowledge. Panel of Fertility Determinants Report No. 3. Washington, D.C: National Academic press.

CUTRIGHT, P., AND W.R. KELLY
1981 The Role of Family Planning programmes on 1958 to 1977 Fertility Declines in Less Developed Countries. International Family Planning Perspectives 7.

_____.,AND D.L. POSTON, JR.
Determinants of Fertility levels and change among Developed countries: An Examination of Adjustment and Innovation Factors. Paper No.3.015. Texas Population Research Center.

DAVIS, K., AND J. BLAKE
1956 Social structure and Fertility: An analytical framework. Economic Development and Cultural change 4:211-235.

EASTERLIN, R.A
1978 The Economics and Sociology of fertility: A synthesis. P 57-113. In C.TILLY (ed.,), Historical Studies of changing Fertility. Princeton, N.J: Princeton University press.

FREEDMAN, R.
1962 The Sociology of Human fertility: A trend report and Bibliography. Current Sociology 10(11):35-121.

FISHBEIN, M
1972 Toward an Understanding of Family Planning behaviour. Journal of Applied Social Psychology 2:214-227.

GARTRELL, J.W.,H.KRAHN., AND F.D SUNHARA

1980 A study of Human Adjustment in Fort McMurry Vol I: Field study and Results. Alberta Oil sands Environmental Research Programm.

_____.,F.D SUNHARA., AND H.KRAHN
1980 Cold Lake Regional Baseline study phase II: Research Methods and Design: Phase II and III. Report 6. Northern Alberta Development Council.

GOLDBERG, D.
1975 Sosioeconomic theory and Differential Fertility: The case of the LDCs. Social Forces 54:84-106.

HASS, P.H
1974 Wanted and Unwanted pregnancies: A Fertility decision-making model. Journal of Social Issues 30:125-165.

HOFFMAN, L.W., AND M.L. HOFFMAN
1973 The Value of Children to Parents. P 19-76. In J.T. FAWCETT (ed.,), Psychological Perspectives on Population. New York: Basic Books.

HULL, T.H
1982 Cultural influence on Fertility decision styles. In R.A. BULATAO AND R.D. LEE WITH P.E. HOLLERBACH AND J. BONGAARTS (ed.,), Determinats of Fertility in Developing Countries. Washington D.C: National Academy press.

JORESKOG, K.G., AND D. SORBOM
1981 LISREL: Analysis of Linear Structural relationships by the method of maximum likelihood. USER's guide. Version V. University of Uppsala.

KELLY, R., AND P. CUTRIGHT
1980 Modernization and the Demographic transition: Cross-sectional and Longitudional Analysis of a Revised Model. Sociological Focus 13:315-329.

LAPIERRE-ADAMCYK, E
1979 Socioeconomic correlates of fertility in Canadian Metropolitan Areas 1961 and 1971. Ottawa: Statistics Canada.

LEIBENSTEIN, H
1974 The Economic theory of Fertility: Promising paths or Blind Alley? Journal of Economic Literature 12:457-479.

1975 The Economic Theory of Fertility Decline. The Quarterly Journal of Economics 89:1-31.

MAULDIN, W., AND B. BERELSON

1978 Conditions of Fertility Decline in Developing Countries 1965-1975. Studies in Family Planning 9:89-148.

NAMBOODIRI, N.K

1972a Some observations on the Economic Framework for Fertility Analysis. Population Studies 26:195-206.

1972b The intergrative potential of a Fertility Model: An Analytical Test. Population Studies 26:465-485.

TSUI, A.O., AND D.BOGUE

1978 Declining World Fertility: Trends,Causes and Implications. Population Bulletion 33, No 4. Washington, D.C. Population Reference Bureau.

WILLIS, R.J

1973 A New Approach to the theory of Fertility Behaviour. Journal of Political Economy 81:s14-s69.

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